ESP 121: Lab 3

Density dependence in discrete time

This lab focuses on the Ricker model, $N_{t+1} = N_t \exp(r(1 - N_t/K))$. For this lab, you will have to run the code for one plot at a time: cut and paste each set of code between the horizontal dashed lines. The first plot, of N vs. r, will give you a sense of which values of r to choose for the tasks below.

1. Plot 2 (first N_t vs. t plot): Choose four values of r that will give different long-term dynamics. For each, write down the value of r you chose and dynamics observed over time.

2. Plot 3 (second N_t vs. t plot): Choose two values of r that will both give chaos and are very close to each other (i.e., the difference between them is small). What do the time trajectories for each value mean for the predictability of population dynamics if the Ricker models is an appropriate description of a population? Hint: think of someone measuring r for a population with some amount of inevitable measurement error, on the level of the difference in the two values you plotted: how will that measurement error affect their ability to predict the population size in two time steps? in 10? 50?

3. Plot 4 (N_t vs. N_0 plot): First change the value of r to one that will give chaos. Then gradually move the time step forward. How does the plot of N_t at various times vs. N_0 illustrate the idea of chaos defined as an initial-condition dependency? Hint: think about how a small change in N_0 will affect N_t at the various points in time: how much of a change do you get, and does it follow a predictable pattern?